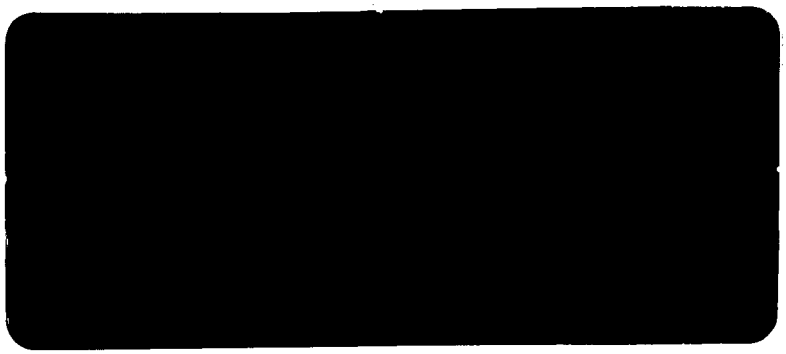

JET PROPULSION LABORATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA

ENVIRONMENTAL IMPACT STATEMENT
FOR THE
JET PROPULSION LABORATORY

FEB 1972

(INSTITUTIONAL STATEMENT)

Jet Propulsion Laboratory
Pasadena, California

PREFACE

This Environmental Impact Statement for the Jet Propulsion Laboratory has been prepared in accordance with NASA Management Instruction NMI 8800.7B. dated Oct. 31, 1971. The Instruction provides guidance to NASA field installations for the preparation of environmental statements as required by the following:

> National Environmental Policy Act of 1969
> (Public Law 91-190), Section 102 (2) (C).
>
> Executive Order 11514, dated March 5, 1970
> ("Protection and Enhancement of Environmental Quality").
>
> Office of Management and Budget (OMB)
> Bulletin No. 72-6, dated September 14, 1971
> ("Proposed Federal Actions Affecting the Environment").
>
> "Guidelines for Statements on Proposed Federal Actions Affecting the Environment," published April 23, 1971 by the Council on Environmental Quality.

The Statement treats the Laboratory as an institution, providing background information about its mission and activities, and addressing the environmental considerations relevant to the planning and operation of its facilities.

The principal facilities of the Laboratory are located at Pasadena, California, but some specialized activities are placed at two "remote" sites -- namely, Edwards Test Station and Table Mountain. In order to assure continuity in the text, the main body of the report concerns itself with the Pasadena site, and the two remote sites are dealt with separately in Section VII.

SUMMARY SHEET

(Format as Prescribed by Appendix 1, CEQ Guidelines, April 23, 1971)

Check: ( ) Draft (X) Final Environmental Statement

Responsible Federal Agency and Operating Division:

National Aeronautics and Space Administration
Jet Propulsion Laboratory

1. Name of Action: (X) Administrative Action ( ) Legislative Action

2. Description of Action:

This statement addresses the Jet Propulsion Laboratory of the California Institute of Technology in institutional terms, describing its mission, facilities, and community setting, and assessing its environmental impact. The statement covers the principal installation at Pasadena, California (Los Angeles County) and specialized auxiliary installations at Edwards Test Station near Mojave, California (Kern County) and Table Mountain near Wrightwood, California (Los Angeles County).

The Laboratory is an established institution tracing its origins to a group of Caltech scientists who in 1936 began organized research in the principles of rocket propulsion. The Laboratory has grown to its present situation through successive periods of government sponsorship by the Army Air Corps (1940-44), Army Ordnance (1944-58), and NASA (1958-present). At the present time the Laboratory supports NASA principally in the conduct of research, development, and flight project activities related to the exploration of the planets and interplanetary space with automated spacecraft.

3. Summary of Environmental Impact and Adverse Effects:

The principal environmental impact of the Laboratory has been in its stimulation of urban growth with the related direct and secondary effects. The situation is now one of maturity, and significant further growth in either the Laboratory or community around it is unlikely. Adverse effects in day-to-day operations are limited to the unavoidable consumption of fuel, power, and other resources, and the disposal of waste products.

4. Alternatives Considered:

Not applicable.

5. Federal, State, and Local Agencies and Other Sources from Which Written Comments Have Been Received:

Environmental Protection Agency

6. Dates Draft Statement and Final Statement Made Available to Council on Environmental Quality and Public:

Draft Statement: March 18, 1971
Final Statement: January 10, 1972

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I. INTRODUCTION AND HISTORICAL BACKGROUND

The Jet Propulsion Laboratory (JPL) is a government-owned facility managed, staffed, and operated by the California Institute of Technology (Caltech) under a contract with the National Aeronautics and Space Administration (NASA). Within the NASA organization, the Laboratory is under the institutional cognizance of the Office of Space Science and Applications (OSSA). JPL has been affiliated with NASA since December 1958 when it was transferred by Executive Order to NASA from Army Ordnance.

JPL traces its origins to a small group of Caltech scientists and students who, about 1936, began careful investigations of both a theoretical and an experimental character into the basic principles of rocket propulsion. This work soon drew the attention of the military and was carried forward with government financial support. Under sponsorship of the Army Air Corps, early efforts were concentrated on the development of solid-and liquid-propellant rocket motors to assist aircraft in take-off. Ground testing of propellant formulations and prototype motors was carried out at a remote site north of Pasadena, California where, as subsequent events have dictated, JPL now stands.

A long period of growth in the evolution of the Laboratory began in 1944, following award of a contract by Army Ordnance for the design and development of complete, long-range, rocket-launched missile systems. Under this new contract, facilities construction began to take on the aspects of permanence, and research projects were initiated in broad areas of physics, chemistry, metallurgy, electronics, and aerodynamics. Pioneering efforts were undertaken in the techniques of telemetry, radio guidance, and inertial

guidance. From these efforts, two successful field weapons systems were developed: the Corporal system, which employed liquid propellants and radio guidance; and the subsequent Sergeant, employing a solid propellant and inertial guidance.

During the 2-3 years immediately preceding the formation of NASA in 1958, JPL worked closely with the Army Ballistic Missile Agency (ABMA) in the development of upper-stage rockets, instrumentation, and telemetry systems for use in nose-cone re-entry tests. This association led to the formation of the JPL/ABMA team which orbited Explorer I in January 1958, following the launch of the Soviet Sputniks in October and November of 1957.

During the following months of 1958, two additional Explorer satellites were successfully orbited, and several follow-on programs were established at JPL and ABMA under the guidance of the Advanced Research Projects Agency (ARPA). Thus, with the establishment of NASA in October 1958, charged with the responsibility to organize and manage the nation's civilian space program, the transfer of JPL to support the effort was a natural development. At this time the Laboratory was an experienced, mature organization employing some 2300 persons.

Under NASA the Laboratory staff grew rapidly, reaching 4300 by 1964. Since that time, the manpower level has fluctuated in the range 4000-4600 positions. Approximately 45% of the staff are engineers and scientists, 24% are technicians and technical aides, and the remaining 31% are administrative, office and service personnel. Nearly half of the technical staff hold advanced degrees in their fields, including about 270 doctorates.

The growth of JPL facilities under NASA has been substantial, primarily because of the increased work force and the need for special laboratories and facilities introduced by the new technologies associated with spaceflight projects. New construction has included engineering and administrative offices, services buildings, space environment simulators and other technical facilities.

II. MISSION STATEMENT

JPL is engaged principally in research, development, and flight project activities related to the exploration of the planets and interplanetary space with automated spacecraft. The Laboratory is project- and mission-oriented and carries out complete projects including mission studies and spacecraft design, development, testing, and flight operations. Technical direction is provided to contractor organizations participating in JPL/NASA projects.

Under NASA, JPL has been assigned broad responsibility for the unmanned exploration of the moon and planets. In carrying out this assignment the Laboratory has had management responsibility for (a) the Ranger project which in 1964 and 1965 produced the first high-resolution television photographs of the lunar surface, (b) the Surveyor project which accomplished five successful soft-landings on the moon in 1966-68, and (c) the Mariner project which has achieved successful flyby missions to Venus in 1962 and 1967 and to Mars in 1965 and 1969.

Currently approved flight projects involving Laboratory responsibility include Mariner IX, an orbiter spacecraft presently enroute to Mars; Mariner Venus/Mercury 1973, scheduled for a single launch to fly near both Venus and Mercury in 1973-74; and the Viking 1975 project in which the Laboratory is developing the Orbiter System and supporting the Langley Research Center in a project to orbit and perform soft landings on Mars in 1975. Congressional approval to begin a program of missions to explore the Outer Planets is anticipated during the FY 1972 budget cycle.

In support of its objectives, the Laboratory conducts broad programs of basic and supporting research and advanced technical development in such fields as spacecraft development, electronics, spacecraft power, chemical and electric propulsion, guidance and control, data handling, and deep space communications, all designed to provide comprehensive and sound technologies for space exploration.

JPL maintains a strong interest and competence in the space sciences and participates actively in scientific investigations involving not only JPL-managed missions but those of other NASA laboratories and centers as well. This work is considered of major importance and significance in the Laboratory's goals and objectives and in its relationships with Caltech and the university community generally. At present, the science programs at JPL are classified into five areas: (a) planetary atmospheres, (b) planetology, (c) astronomy and astrophysics, (d) space physics, (e) exobiology.

A further aspect of the Laboratory's role lies in its management of the world-wide facilities of the NASA Deep Space Network (DSN). JPL designed and developed the facilities of the DSN, and conducts a continuing research and development program to assure superior techniques and facilities to support deep space missions. The Laboratory provides technical direction for station operation and maintenance, which are now largely contracted.

III. INSTALLATION DESCRIPTION

A. LOCATION AND COMMUNITY SETTING

The Jet Propulsion Laboratory is located in the Los Angeles metropolitan area in the extreme northwest portion of the City of Pasadena. The site, which has gradually expanded during the growth of the Laboratory, presently consists of 174 acres, of which 146 acres are Government owned and the remainder are leased. The principal buildings and other facilities are situated on the west bank of a normally dry stream or wash known as the Arroyo Seco. This site was undeveloped and remote at the time the Laboratory was founded, but it is now bounded by urban developments. Residential areas of Altadena and Pasadena lie to the east just beyond the Arroyo, and La Canada, a neighborhood of high-value single-family homes, adjoins the Laboratory site on the west and northwest. The foothills of the San Gabriel mountains and the canyon of the Arroyo Seco lie to the north. The near areas to the south are occupied by a station of the U.S. Forest Service, a fire control camp of the Los Angeles County Fire Department, a 38-acre privately-owned riding club, La Canada High School, Devils Gate Dam, water conservation basins (to recharge underground reservoirs) of the City of Pasadena, and a public park.

Significant expansion of the JPL site is precluded by the existing peripheral land conditions and uses. Although acquisition of one or more of the small leased parcels is possible at some future time, present planning does not contemplate enlargement of the site.

The main access to the site is provided by Oak Grove Drive, four lanes wide, from the south. There is limited access from the east through the

residential areas and via a bridge across the Arroyo. The Foothill Freeway, a portion of which has been completed, passes within a mile of the Laboratory and is accessible via Oak Grove Drive. By 1975, construction progress on the Foothill route and connecting links will place virtually all portions of the metropolitan area within reach over the freeway system.

The Laboratory site is not effectively served by public transportation systems, a factor of significance in planning roads and parking facilities.

B. TOPOGRAPHY, GEOLOGY, CLIMATE

The Laboratory is situated on an alluvial fan, composed largely of gravel, boulders, and decomposed granite, at the base of the San Gabriel Mountains. The site rises in elevation from 1075 feet to 1550 feet in proceeding from south to north. The entire northern portion of the site is steep and mountainous, but topped by a fairly level ridge which has been developed as an antenna testing range. Most of the Laboratory buildings and improvements are located on the lower (south) portion of the site, which is the alluvial deposit, with slopes to about 14%.

The San Gabriel Mountains rise to general elevations above 5000 feet, peaks to 10,000 feet, and comprise a range extending in an east-west direction for a distance of about 60 miles. They are bounded on all sides by complex fault systems, highlighted by the San Andreas which follows the north side of the range.

The climate in the Los Angeles basin is semi-arid, characterized by mild winters and warm, dry summers. Rainfall at the Laboratory location near the mountains averages about 15 inches per year, but varies widely from about 10 to 40 inches. Virtually all precipitation occurs during the winter months. The region is without violent storms with the exception of occasional Santa Ana winds which sometimes cause damage to trees, buildings, power lines, etc.

C. FACILITIES

The JPL Pasadena site presently contains some 180 buildings and structures of all types. This number includes about 20 contemporary multi-story office and laboratory buildings of major importance, constructed during the past ten years or so; included also are many of the earliest small wood and stucco structures which are still utilized for limited purposes. The presently available office and laboratory space is approximately 1.5 million gross square feet. The value of the investment in physical plant -- i.e., land, buildings, and equipment -- is estimated at $200 million.

Technical facilities at JPL provide capability for a wide range of research and development activities, and for specific project-oriented functions such as spacecraft assembly and checkout and environmental testing. Included in this category are such facilities as the 10-foot and 25-foot-diameter space simulators, supersonic and hypersonic wind tunnels, environmental testing laboratories, inertial sensors laboratory, antenna range, and many others. Hazardous operations, specifically those involving the handling of propellant materials and the testing of propulsion systems, have been discontinued at the Pasadena site and removed to the Edwards Test Station (see Section VII -A). Other JPL facilities, employed in (a) research activities in optical and radio astronomy and (b) evaluation of solar power devices, are located at Table Mountain (Section VII -B).

The development and improvement of the JPL site and facilities and the coordination with roads, utilities, landscaping, etc. are guided by a Master Plan and Master Planning Board, and implemented through the services of professional architect and engineering firms. This policy and practice has been very effective in maximizing the utilization of the site, organizing

general zones of land use, modernizing utility services, and improving roads, traffic flow, and parking. Considerable attention has been given also to the eventual removal of old buildings and the re-development of cleared areas. Because of the site's elevation and sloping nature, the Laboratory facilities are readily visible from surrounding areas. For this reason appearance is and has been an important consideration in facilities planning.

In this connection the landscaping of the site is noteworthy. At the entrance to the Laboratory a central mall has been constructed, featuring a fountain and small lake and incorporating numerous planters, rolling lawns, and extensive areas of textured paving. Plantings include a number of large trees and shrubs bringing about the feeling of a matured landscape. In addition to providing an attractive entrance to the Laboratory and creating a pleasant environment, the mall serves to unify the principal office buildings and the main entrance and to accommodate the heavy pedestrian traffic between these buildings. Elsewhere on the site landscaping effort has been less concentrated, but trees, shrubs, and erosion-controlling ground covers are widespread. A considerable effort has been devoted to benching, planting, and installing sprinkler systems on hillside areas above and behind the principal Laboratory buildings where construction activities have removed the native growth.

D. UTILITY SERVICES

1. Power

Electric power is supplied to JPL by the Southern California Edison Company from its Arroyo Seco Substation. Distribution voltages are 2.4 KV and 16.5 KV except for one line at 66 KV which serves a group of test facilities requiring high power. The 2.4 KV lines are being replaced with 16.5 KV as a standard. The distribution system is presently a combination of overhead lines and underground cable, but overhead lines (except for the 66 KV) are being placed underground as rapidly as opportunities permit. This work, and in fact the improvement and modernization of all other utility distribution systems also, is being coordinated with a number of planned street-improvement projects.

2. Natural Gas

Natural gas is supplied to the site through a pipeline along Oak Grove Drive, served by the Southern California Gas Company. Delivery pressure is 100 psi to a metering and pressure reducing station located in the southwest corner of the JPL property. Buildings throughout the Laboratory are supplied through a distribution network at a pressure of about 5 psi. Gas consumption is in the neighborhood of 240 million cubic feet annually.

3. Water

Water is supplied from City of Pasadena mains to JPL's booster pumping station. Here the water is pumped directly into the distribution lines and into three storage reservoirs which float on the system to prevent sudden pressure changes due to starting and stopping of the pumps. Water usage during the year 1970 was 190 million gallons. The storage reservoirs have a capacity of 2.2 million gallons and are sized primarily to handle emergency fire fighting demands.

4. Sanitary Sewers

The sanitary sewer system is a combination of gravity and force mains and requires three pumping stations. The entire flow is discharged into the Oak Grove Drive out-fall sewer under agreements with the City of Pasadena and Los Angeles County. The maximum allowable flow rate under these agreements is 500 gallons per minute. This does not constitute a significant limitation at the present time. The metered discharge in a typical year is about 60 million gallons.

5. Storm Drain System

The handling of storm water on the JPL site presents somewhat unusual problems due to the steep undeveloped land in the north portion and the circumstance that all run-off from this land must pass through the developed areas below it. In its present state of development the system handles all major flows in underground channels. System capacity is adequate to handle a storm of 50-year severity. All storm water from the site is discharged into the Arroyo Seco channel which borders the Laboratory on the east.

IV. POLICIES, PROCEDURES, AND PROGRAM ACTIVITIES OF ENVIRONMENTAL SIGNIFICANCE

A. CODES AND STANDARDS APPLICABLE TO JPL

As a Federally-owned installation the Laboratory is legally outside the jurisdiction of many of the city and county building codes and regulations. On the other hand, since Caltech is incorporated in the State of California, and workers at JPL are Caltech rather than Federal employees, many provisions of the California Administrative Code, for example those relating to industrial safety, do apply. Regardless of legal questions, JPL as a matter of policy cooperates to the fullest extent with local and state regulatory agencies in its building programs and in the operation of its facilities. This will be apparent in some of the specific details mentioned later in this section.

Documents of primary significance in defining standards and practices at the Laboratory include the following:

NASA Facilities Engineering Handbook, NHB 7320.1

Uniform Building Code, Volumes I and II

Uniform Plumbing Code

California Administrative Code, Title 24, Chapter 4, Basic Electrical Regulations

California Administrative Code, Title 8, Chapter 4, Division of Industrial Safety - - Safety Orders

NFPA Fire Prevention Codes, Volumes 1 - 10

Walsh-Healey Act, Part 50-204, Safety and Health Standards for Federal Supply Contracts

Prevention, Control and Abatement of Water Pollution, NASA NMI 8800.3A

Prevention, Control and Abatement of Air Pollution, NASA NMI 8800.4

In instances where national codes, as specified for example in NHB 7320.1, are at variance with state codes or the Uniform Building Code, the more restrictive requirements are satisfied.

With respect more specifically to questions of environmental significance, the Laboratory is fully responsive to the following local controls, in addition to those of Federal origin incorporated in legislation, Executive Orders, NASA instructions, etc:

Los Angeles County Health Department

Los Angeles County Air Pollution Control District

Los Angeles County Sanitation District

City of Pasadena Water Department

B. SANITARY SEWERS

As mentioned previously, the sanitary sewer flow originating at the Laboratory is metered in quantity and then discharged directly into the facilities of the City of Pasadena and Los Angeles County. County regulations govern the content of this flow with regard to industrial-type wastes and pollutants, and the Laboratory has established and maintains appropriate controls at the source. Objectionable chemical wastes, toxic materials, grease and lubricants, paint wastes and thinners, solvents, etc. are in a few instances neutralized or otherwise treated and filtered and then passed into the sewer, but much more commonly such materials are held in retention tanks for subsequent removal by licensed contractors to regulated industrial-waste-disposal sites. The Los Angeles County Division of Industrial Waste makes periodic inspections of these facilities and procedures.

Waste water from cooling towers enters the sanitary sewers directly. Water treatment is performed under contract by a firm specializing in this field. Chromate-type products, which in many installations are objectionable, have been eliminated entirely. Additionally, phosphate concentrations have been reduced to very low levels, well below the standards set by the Sanitation District.

C. STORM DRAINS

The only materials entering the storm drain system are those that originate as surface run-off. Besides rain water, small quantities of waste water (merely untreated tap water) from single-pass cooling uses (such as cold boxes and diffusion pumps) and run-off from irrigation operations are the only specific sources. The wash-down of accidental spillage is always a possible contributor, but the real liklihood of a significant incident of this kind is considered very remote.

Waste water from irrigation operations is a matter of particular interest and concern because of the possible presence of pesticides and fertilizers (see also Item G below) in the flow. The precautions observed in this regard are to avoid over-watering, to use care in the application of pesticides and fertilizers, and to minimize their use consistent with real needs.

The discharge from the storm drains is directly to the Arroyo Seco where it joins the natural flow. The point of immediate interest is that much of the Arroyo flow enters natural underground reservoirs through percolation basins where it becomes a source of well water to the City of Pasadena. The City's program of protecting these waters from contamination includes almost daily examination of the discharges from the Laboratory's storm drains. The operating experience over the years has been that there are no significant problems in this situation.

D. ATMOSPHERIC EMISSIONS

The problems of air pollution in the Los Angeles basin are well known, and the rules and regulations that cope with these problems, as developed and enforced by the Los Angeles County Air Pollution Control District (APCD), are among the most far-reaching and restrictive anywhere. The Laboratory cooperates fully with the APCD, and its operations are in full compliance with all applicable requirements.

With one exception to be mentioned, all fuel burned at the site is natural gas. No coal or oil is used either as primary or standby fuel. There are no sources smoke or ash. Emissions of oxides of nitrogen and other products of combustion are within the limits set by the APCD.

The exception referred to above is the standby power plant used in support of space-flight operations. This plant consists of three 1380 KW generating units powered with dual-fuel type piston engines. These engines are started with diesel fuel and then switched to a mixture of 8% diesel oil and 92% natural gas. At operating temperatures on the fuel mixture there is no visible exhaust. The APCD has examined and tested this installation and finds no difficulties with it; for example, at full load nitrogen oxide emissions are only a little more than half the allowable. It is estimated that in its standby role, this plant will operate less than 500 hours per year.

The use of paints, thinners, and solvents is in compliance with APCD standards. Waste materials are held in retention tanks. All gasoline storage is underground; fumes are avoided through the use of bottom-outlet fill pipes.

One program activity requiring special provisions is concerned with the experimental evaluation of beryllium as an additive in solid propellants. This work involves the preparation and firing of laboratory quantities of propellant. The extreme toxicity of beryllium is fully recognized, and elaborate precautions are in effect to prevent its release into the environment. The work is confined to one building, and therein within a series of airlocks. All circulating and exhaust air that could possibly become contaminated is thoroughly washed and filtered before release. The wash water itself is filtered before passing into the sanitary sewer. Used filter materials are carefully packaged and disposed of under contract. Although the escape of toxic materials from this building is considered to be extremely unlikely, air around the building is monitored for contamination.

E. DISPOSAL OF SOLID WASTES

All solid waste materials, including paper, garbage, construction scrap, etc. (some 900 cubic yards per week) are disposed of in a nearby sanitary landfill which serves Pasadena and neighboring communities. Scrap metal and some paper products (for example IBM cards) are disposed of as salvagable material.

F. RADIOACTIVE MATERIALS

The Laboratory's possession and use of radioactive materials are licensed by the State of California and the Atomic Energy Commission. A special Radiation Safety Committee, composed of staff members knowledgeable and experienced in the handling and safeguarding of radiation sources, administers the Laboratory's responsibilities under these licenses. The Committee authorizes uses, prepares hazard analyses, establishes safety practices, approves facilities in which radiation sources will be used, and generally supervises and monitors all Laboratory activities in which radiation hazards may be a factor.

As a consequence of the precautions observed, significant hazards are in fact not present in the activities of the Laboratory. Quantities of materials are small and limited to laboratory uses. In the event of a ruptured capsule or other spillage, the released materials would be contained within the laboratory in which they are used. Waste materials are handled in accordance with the California Administrative Code, Title 17, Chapter 5, and disposed of through a licensed disposal firm.

G. PESTICIDES

The use of chemicals and bait at JPL in the control of rodents, insects, and weeds is reported in detail annually to the Division of Occupational Medicine and Environmental Health, NASA Headquarters, for incorporation into its "Report on Pesticides Used at NASA Installations". This report is prepared primarily for the use of the Federal Committee on Pest Control, which annually reviews NASA's pest control programs and advises regarding procedures to achieve desired results while minimizing adverse effects. This process provides assurance that the pest control program is efficient and effective and contributes minimum hazard to the environment.

It is the Laboratory's practice to use only registered pesticide materials where these are available, and to have all materials applied by a licensed contractor, experienced in this field.

V. ENVIRONMENTAL IMPACT

This section addresses directly the topics specifically called out in Paragraph 6 of the Guidelines formulated by the Council on Environmental Quality (CEQ) for the preparation and content of environmental statements. The section is not intended to stand by itself as complete coverage of the subject matter. Rather, it depends on the balance of the statement for background, support, and continuity.

A. PROBABLE IMPACT OF JPL OPERATION ON THE ENVIRONMENT

The Jet Propulsion Laboratory is a major division of Caltech, an employer of some 4000 persons, and a spender each year of $200 million (more or less) in Federal funds. It is without question a significant entity in the community and the environment. Its existence stimulates and in various ways influences the growth and prosperity of the community -- the use of land for housing, the building of utilities and highways, the establishment and growth of commercial enterprises, and the construction of schools, churches, and cultural centers. Whether the acceleration in the urbanization of the area, attributable to the evolution of the Laboratory, constitutes a plus or a minus in a broad sense is a somewhat philosophical question which can hardly be dealt with here, but there is an important point to be made which is that in addressing the question of "impact on the environment" for an existing institution such as JPL, the secondary effects,if they could all be identified, would probably far outweigh the primary ones.

In any event, the major growth and evolution of both the Laboratory and the community around it have by now taken place, and the situation is one of maturity and stability. It is unlikely that growth as such

will have any further significant impacts on the ecology or environment of the region.

In terms of on-going day-to-day activities it should be understood that JPL is a scientific and engineering organization. Its work activities utilize mainly office-type space and small clean laboratory facilities. Its products are primarily intellectual in character. There are no fabrication, manufacturing, or testing activities in an industrial sense. Many chemicals, solvents, toxic, and uncommon materials would appear in an inventory, but these are used only in laboratory quantities by persons familiar with their properties. They are in no way a threat to the environment. The so-called "major test facilities" at the Laboratory are major in the sense of uniqueness, in their size and performance relative to similar facilities elsewhere, or in their importance to the development of flightworthy spacecraft, but they are not major in being conspicuous by their presence, nor are they sources of air or water pollution or noise or other objectionable quality; in other words, it would be incorrect to infer that as "major" they must have an adverse environmental impact.

As is true of any enterprise employing people and performing work, the Laboratory generates its share of waste products. The disposition of these is described in Section IV above, and is believed to be in all instances in accordance not only with applicable regulations but also with the best practices available.

B. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IN THE OPERATION OF JPL

In a literal sense virtually all activities of man seem to have adverse environmental effects of one sort or another attributable to them, appearing if not locally, then somewhere else, but somewhere. The obligation and challenge then lies in minimizing them for each set of circumstances. In the case of the Laboratory, it does not appear to be engaged in activities extraneous to its mission, and its essential work is not recognized as producing unnecessarily adverse effects. As remarked above, the Laboratory has had a part in the urbanization of the area, and this may be regarded by some as adverse. As remarked also, the Laboratory's activities consume resources and generate waste products. These conditions fall in the category of adverse, but the handling of them, as outlined in Section IV, is believed to meet the obligation of minimization. Consequently, they are regarded essentially as unavoidable, subject of course to improved methods that may in time appear.

Some activities of the Laboratory, specifically rocket-propulsion tests, which were formerly important at the Pasadena site have been discontinued there and moved to the Edwards Test Station in the desert. This action has been in recognition of the incompatibility of this work with the Pasadena environment; it recognizes and removes an adverse situation.

C. ALTERNATIVES TO THE OPERATION OF JPL

JPL is an existing institution engaged principally in various aspects of the nation's space program as outlined in Section II. The alternative to its operation is abandonment, which is hardly practical, nor is there any reason to suppose that such an eventuality would result in any net gain to the environment. The reasonable alternatives lie in the methods of its operation, and the ways in which future program activities are carried out. With regard to the latter, there are no prospective programs that lie outside the present mission statement. If and when they should arise, they will be subject to environmental assessment in their own behalf. With regard to methods of operation, it is expected to cooperate fully with all advisory and regulatory agencies and to employ the most modern devices and practices available.

D. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The operation of JPL does not, at least at this stage, involve short-term uses with long-term implications for the environment. The development of the Laboratory has influenced the economic growth, the use of land, and the distribution of population in the vicinity. These are essentially long-term irreversible conditions having environmental implications, but they are evolutionary in character and not relatable to temporary or short-term activities. The present situation as far as both the community and Laboratory are concerned is one of maturity and stability. As far as the matter is understood, there are no actions occurring with potential cumulative effects.

E. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF NATURAL RESOURCES WHICH ARE INVOLVED IN THE OPERATION OF JPL

The operation of JPL does not involve the commitment of natural resources beyond the use of a certain amount of land and the obvious consumption of fuel, water, and electric power.

VI. COORDINATION WITH LOCAL, STATE, AND FEDERAL AGENCIES

A draft environmental statement for the Jet Propulsion Laboratory was submitted to NASA Headquarters at the end of February 1971. It, together with other drafts from other NASA field installations, was submitted to CEQ for comments, coordinated with other Federal agencies, and called to the attention of state and local agencies through notice in the Federal Register (Vol.36, No. 53, March 18, 1971), all procedures in accordance with NMI 8800.7B. A few comments with regard to statement content were received from the Environmental Protection Agency, and they have been accommodated in the preparation of this final statement.

Independent of this process, the Laboratory cooperates fully with state and local agencies in its building programs and the operation of its plant. This has been fully described elsewhere.

Community relations generally are good. The JPL Community Relations Board, with representation from local property owners, business associations, etc., has long been effective as a means of discovering problems or concerns in the community and exchanging views and information. The Laboratory is participating in a recently organized master planning activity for the Arroyo Seco. Other participants in this activity include the City of Pasadena (Departments of Water and Power, and Parks), L. A. County Flood Control District, L. A. County Department of Parks and Recreation, Metropolitan Water District, and U. S. Forest Service. Such associations have obvious value in bringing about a familiarity of all concerned with mutual problems.

VII. ADDITIONAL INFORMATION RELATING TO OFF-SITE ACTIVITIES

A. EDWARDS TEST STATION

The Edwards Test Station (ETS) occupies approximately 600 acres near the northern boundary of and within Edwards Air Force Base. The location is about 15 miles east of Mojave, California and 70 miles north of the JPL site in Pasadena.

The site was first utilized by JPL in 1945 in developmental firings of rocket motors for the Corporal missile system. Today, the test station provides JPL with an isolated site and installations specifically designed for the safe handling of liquid- and solid-propellant materials, and for the development and testing of complete rocket propulsion systems with thrust levels up to about 50,000 pounds. One aspect of the work at ETS is concerned with the evaluation of propellant formulations in terms of performance, handling qualities, storability, and compatibility with other materials. Development work on propulsion system hardware involves components such as propellant tanks, valves, injectors, thrust chambers, nozzles, and the like, and also firing tests of complete prototype or flight-ready systems. This work is an integral part of the JPL mission, it being removed to ETS in recognition of its hazardous nature and incompatibility with the facilities and urban environment of the Laboratory in Pasadena.

Selection of the ETS site and its subsequent evolution have been guided specifically by the requirements of propulsion testing. The site is isolated relative to urban and other developments. It is situated within the boundaries of the 500-square-mile property of the Edwards Air Force Base, being surrounded on three sides by the Air Force property, and bounded on the north side by

highway U. S. 466 and undeveloped desert land beyond. There are no communities within a radius of 10 miles.

The site is level, at an elevation of 2200 feet, in a sandy plains area of the Mojave Desert. The climate is arid. Temperature extremes are approximately 15° in the winter to 110°F in the summer. Winds are common, usually westerly, sometimes producing sandstorms. Thunderstorms occur occasionally during the summer months.

The principal technical facilities at the Station are in the following categories:

(a) Solid propellant processing facilities consisting of a group of small buildings devoted to ingredient preparation, mixing, curing, and storage in batches up to 150 gallons.

(b) Test stands for both liquid and solid propellant motors. Thrust levels to 50,000 pounds can be accommodated on one stand. Various degrees of altitude and space simulation can be provided.

(c) A vibration test facility suitable for tests involving fueled propulsion systems, pressurized vessels, and pyrotechnic devices.

(d) A control and recording center providing for safe, remote operations.

All facilities at the site are designed, constructed, located, monitored, and controlled in accordance with conservative practices and due regard for the hazards involved. The requirements of the "Explosives Safety Manual", Department of the Air Force, AFM 127-100, are complied with.

Electrical power and water for the site are obtained by connections in the supply lines to Edwards Air Force Base. Fuel consists entirely of liquified petroleum gas (LPG) except for about 1500 gallons per year of fuel oil used for a boiler in one building.

Sewage disposal at the site is by means of septic tanks and leach fields, this method being entirely acceptable in this area due to the nature of the soil, absence of ground water, and the impossibility of contamination of any water supplies or sources. Industrial-type liquid wastes, for example, spilled fuels or oxidizer, chemicals, and toxic materials, are washed into retention tanks or evaporation ponds for subsequent treatment and disposal.

Scrap solid propellants (50 to 100 pounds per week) are presently disposed of by burning in an open pit. However, a new propellant incineration facility is presently funded and under design. The new facility will assure controlled burning at high temperature and will provide a scrubber system for the exhaust gases. These features will be very effective in reducing air pollution from propellant burning operations.

The operations of ETS at their present scale do not appear to constitute a threat to the environment. The remote location of the site minimizes its impact in terms of noise, site, odors, or toxic conditions. Based on experience in operating the facility, pollution controls appear to be effective, and there are no outstanding problems. It is planned to continue full coordination and cooperation with regulatory agencies, and there are no reasons to expect adverse environmental conditions to arise in the future.

B. TABLE MOUNTAIN FACILITY

The JPL Table Mountain facilities occupy approximately 10 acres at the summit of Table Mountain, elevation 7500 feet, near Wrightwood, California. The site is about 65 miles northeast of Pasadena and is readily accessible by paved highway except for occasional short periods when the final few miles may be closed by snow during or immediately following winter storms. Table Mountain is situated within Los Angeles County in the Valyermo Ranger District of the Angeles National Forest. JPL occupies the site under the terms of a Special Use Permit granted by the U. S. Forest Service.

The Table Mountain Facility contributes importantly to the Laboratory's overall mission in providing facilities for (a) astronomical observations and research and (b) for the development and testing of solar-power devices for spacecraft application. The site is particularly well suited for both of these purposes because of its high altitude and clear, stable, dry air. It is widely recognized on the basis of several telescope-site surveys as one of the better astronomical observatory sites in the southwestern United States.

The Table Mountain site was originally occupied by the Smithsonian Institution of Washington, D.C., beginning in 1926. For many years the Smithsonian pursued programs in solar spectroscopy and the measurement of solar radiation intensity. However, by 1961 this work had progressed about as far as it could at this site, and the Smithsonian elected to close its facility. The timing was fortuitous for JPL, and the Laboratory acquired the site and buildings in May 1962.

A number of the Smithsonian buildings, all small wood-frame structures, remain on the site and are used by the Laboratory for various purposes. However, these are gradually being replaced, and the significant facilities presently on the site are those that have been constructed by JPL. These include:

(a) 16-Inch Telescope Observatory (Optical)

(b) 24-Inch Telescope Observatory (Optical)

(c) Radio Telescope - - An 18-foot diameter millimeter wave antenna used in radio-astronomy research.

(d) Solar Power Test Laboratory -- High-bay metal buildings (approximately 2500 square feet) and adjoining test pads.

(e) Industrial Users Area - - Test pads and utility services developed at NASA's request to provide government contractors with the benefits of Table Mountain conditions for testing of solar-power devices.

(f) Headquarters Building - - A one-story residential-type structure with slump stone exterior providing office space, conference room, and library, and sleeping accommodations for astronomers on duty.

(g) Services Building - - A building similar in construction to the Headquarters Building providing for shops, storage, and garage space.

Electrical power and telephone service are available at the site from commercial sources. Water is available from a Forest Service storage tank (315,000 gal.) which is filled from wells in the valley near Wrightwood. This supply also serves a number of private organization camps and a public campground in the vicinity, but its primary function is as a fire-fighting reserve. All fuel requirements of the site are supplied by bottled gas (LPG) stored near the point of use. Sewage disposal is by means of septic tanks and cesspools, a

method entirely acceptable in this area for the small quantities involved and approved by the Forest Service and county health authorities. Rubbish is disposed of at a community facility.

Areas within the National Forest surrounding the JPL site contain numerous recreational facilities including youth camps, a public campground, and ski slopes. It is likely that as time goes by these activities will expand somewhat, but there appear to be no significant incompatibilities between the prospective recreational uses of the Forest lands and the utilization of the Table Mountain summit for scientific purposes.

The environmental impact of the JPL facility is principally in terms of the space it occupies and its appearance, rather than as a source of air or water pollution, noise or objectionable activity. The Laboratory and the Forest Service intend to keep it that way. Compatibility among uses and users of the National Forest is of concern to all, and the Forest Service has exercised great caution in its approval of developments at the site. Every effort is made to keep buildings inconspicuous. Trees and other natural vegetation are preserved with care.